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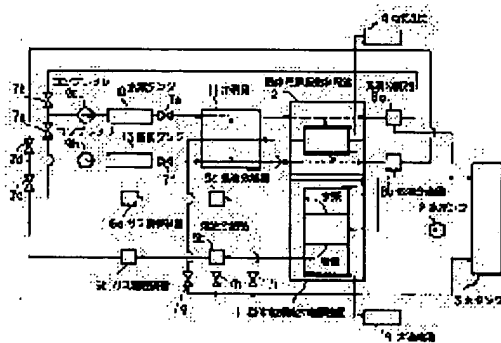
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(54) CLOSED TYPE FUEL CELL SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a perfectly closed system to eliminate fuel consumption and emission matter, and make the system clean and compact by using the hydrogen gas and oxygen gas generated by electrolysis of water as fuel and oxidizing agent.

SOLUTION: The water stored in a water tank 3 is pressurized by a water pump 2 and sent to a solid electrolyte water electrolytic device 1. Power is supplied by a solar battery 5 to electrolyze the water into hydrogen and oxygen gases. The generated hydrogen gas and oxygen gas are increased in purity by gas purifying devices 6a, 6b after moisture is removed by first gas-liquid separators 5a, 5b, pressurized by compressors 9a, 9b, and stored in a hydrogen tank 10 and an oxygen tank 13, respectively. The hydrogen for the fuel of a solid electrolytic fuel cell 12 and the oxygen for oxidizing agent are stored in the tank 10 and the tank 13, respectively, and when required, they are guided to the cell 12 after humidified to a saturated steam pressure by a humidifier 11 through valves 7e, 7f to generate electricity. Thus, a closed system can be provided, and the system can be made clean and compact.



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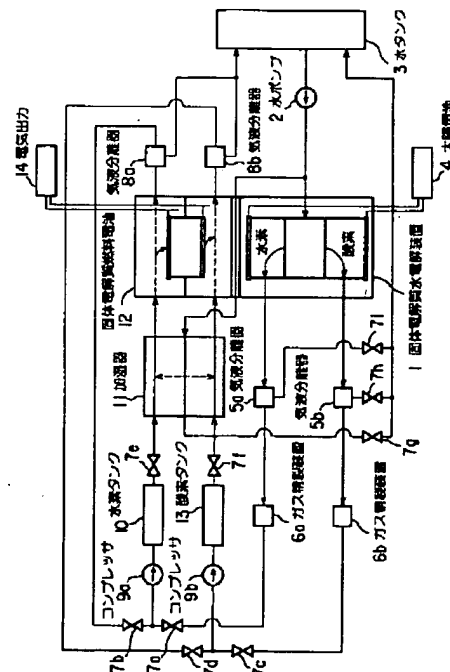
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(54)【発明の名称】 クローズド型燃料電池システム

(57)【要約】

【課題】複合発電システム全体が大規模となり、構成機器も複雑になる。

【解決手段】固体電解質水電解装置(12)と、水電解装置へ供給する水が収容された水タンク(3)と、水電解装置へ電気を供給する電源装置(4)と、水電解装置で生成された水素と酸素から水分を除去して水タンク(3)へ戻す気液分離器(5a, 5b)と、水電解装置で生成された水素を貯蔵する水素タンク(10)と、水電解装置で生成された酸素を貯蔵する酸素タンク(13)と、水素タンク(10)からの水素と酸素タンク(13)からの酸素を反応させて電気を発生させる固体電解質燃料電池(12)と、この燃料電池(12)の水素、酸素系の排気から夫々水分を除去し、水タンクへ戻す気液分離器(8a, 8b)と、この気液分離器で水分を除去されたガスを前記水素タンク(10)及び酸素タンク(13)へ戻すコンプレッサ(9a, 9b)とを具備することを特徴とするクローズド型燃料電池システム。



【特許請求の範囲】

【請求項1】 固体電解質水電解装置と、この水電解装置へ供給する水が収容された水タンクと、前記水電解装置へ電気を供給する電源装置と、前記水電解装置で生成された水素と酸素から水分を除去して前記水タンクへ戻す第1の気液分離器と、前記水電解装置で生成された酸素を貯蔵する酸素タンクと、前記水素タンクからの水素と前記酸素タンクからの酸素を反応させて電気を発生させる固体電解質燃料電池と、この固体電解質燃料電池の水素及び酸素系の排気から夫々水分を除去し、前記水タンクへ戻す第2の気液分離器と、この第2の気液分離器で水分を除去されたガスを前記水素タンク及び酸素タンクへ戻すコンプレッサとを具備することを特徴とするクローズド型燃料電池システム。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、移動体用の電源装置や離島の灯台等人がいきにくい地点に設置する電源装置に適用可能なクローズド型燃料電池システムに関する。

【0002】

【従来の技術】周知の如く、これまでの燃料電池は燃料として天然ガス、石炭ガス化ガス等を用いるため、その余剰分は燃料供給系に戻るか、ガスタービン等に作動流体として供給され、発生した水分は水処理装置に回収されたりしていた。このため、燃料電池は複合発電システムの一構成機器となり、システム全体は大規模となり、構成機器も複雑になってしまった。また、発電のみ行う燃料消費型のシステムである。

【0003】

【発明が解決しようとする課題】この発明はこうした事情を考慮してなされたもので、燃料電池の燃料及び酸化剤に水の電気分解にて発生する水素ガス、酸素ガスを用いることにより、システムを完全にクローズシステムとし、これにより燃料消費及び排出物をなくし、クリーンでコンパクトなクローズド型燃料電池システムを提供することを目的とする。

【0004】

【課題を解決するための手段】この発明は、固体電解質水電解装置と、この水電解装置へ供給する水が収容された水タンクと、前記水電解装置へ電気を供給する電源装置と、前記水電解装置で生成された水素と酸素から水分を除去して前記水タンクへ戻す第1の気液分離器と、前記水電解装置で生成された水素を貯蔵する水素タンクと、前記水電解装置で生成された酸素を貯蔵する酸素タンクと、前記水素タンクからの水素と前記酸素タンクからの酸素を反応させて電気を発生させる固体電解質燃料電池と、この固体電解質燃料電池の水素及び酸素系の排気から夫々水分を除去し、前記水タンクへ戻す第2の気

液分離器と、この第2の気液分離器で水分を除去されたガスを前記水素タンク及び酸素タンクへ戻すコンプレッサとを具備することを特徴とするクローズド型燃料電池システムである。

【0005】即ち、この発明に係るクローズド型燃料電池システムは、燃料供給系として、水を保管する水タンク、水タンク中の水を吸収し下流へ送る水ポンプ、固体電解質水電解装置、同水電解装置に電気を供給する電源装置、同水電解装置にて発生した水素、酸素より水を分離する第1の気液分離器、水素タンク、酸素タンク、コンプレッサ、配管及びこれらの水、水素ガス、酸素ガスの流れを制御する複数の弁を備え、また生成物排出系として、第2の気液分離装置、同気液分離装置にて分離した水を前記水タンクに送る配管、同部気液分離装置にて分離した水素、酸素ガスを夫々のタンクへ戻す配管及び複数の弁を備えたことを特徴とする。

【0006】この発明において、余剰電力がある時（例えば太陽電池作動時）に水タンクより水を固体電解質水電解装置に導き、これを酸素と水素に電気分解する。発生した水素、酸素は別々にタンクに保管する。余剰の水は水タンクに回収する。また、電力必要時に、水素タンク及び酸素タンクより貯蔵されたガスを固体電解質燃料電池の燃料極、空気極へ導き発電する。発生した水は水タンクに回収する。未反応の水素及び酸素ガスは夫々のタンクへ戻す。

【0007】

【発明の実施の形態】以下、この発明の一実施例を図1を参照して説明する。なお、図1は、この発明を宇宙空間を航空する人工衛星等の宇宙機器に搭載する場合の系統を示す。図中の符番1は、固体電解質水電解装置である。この水電解装置1には、水ポンプ2を介装した配管を介して水タンク3が接続されている。また、前記水電解装置1には、電源装置としての太陽電池4が接続されている。前記水電解装置1には、第1の気液分離器5a、5bが接続されている。ここで、一方の気液分離器5aにはガス精製装置6aが接続され、更にこのガス精製装置6aには弁7a、7bを介して第2の気液分離器8aが接続されている。他方の気液分離器5bにはガス精製装置6bが接続され、更にこのガス精製装置6bには弁7c、7dを介して第2の気液分離器8bが接続されている。前記第2気液分離器8a、8bは、共に前記水タンク3に接続されている。

【0008】前記弁7a、7b間の配管と前記第2の気液分離器8aを結ぶ経路には、コンプレッサ9a、水素タンク10、弁7e、加湿器11及び固体電解質燃料電池12が順次設けられている。また、前記弁7c、7d間の配管と前記第2の気液分離器8bを結ぶ経路には、コンプレッサ9b、酸素タンク13、弁7f、前記加湿器11及び固体電解質燃料電池12が順次設けられている。なお、図中の符番7g、7h、7iは弁、符番14は前記固体電解

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質燃料電池12の電気出力を示す。

【0009】こうした構成のクローズド型燃料電池システムの作用は、次の通りである。まず、水タンク3に蓄えられた水は、水ポンプ2により加圧され、前記水電解装置1へ送られる。ここで、太陽電池4により電力の供給を受け、水素、酸素ガスに電気分解される。発生した水素ガス、酸素ガスは、夫々第1の気液分離器5a、5bにて水分を除去した後、ガス精製装置6a、6bにより純度を上げ、コンプレッサ9a、9bにて加圧し、水素タンク10、酸素タンク13に貯蔵する。第1気液分離器5a、5bにて分離された水は弁7h、7iを介し水タンク3に戻される。

【0010】固体電解質燃料電池12の燃料の水素は水素タンク10、酸化剤の酸素は酸素タンク13に貯えられていて、必要時に弁7e、7fを介して加湿器11により飽和蒸気圧まで加湿された後、固体電解質燃料電池12に導かれ、ここで発電する。加湿器11の水源は固体電解質水電解装置1の水供給系の水ポンプ出口より分岐する。燃料電池の生成物の水は、空気極側に発生する第2の気液分離器8bにて分離され、水タンク3に回収される。余剰の水素、酸素は気液分離器8a、8bにて水分を除去した後、夫々水素タンク10、酸素タンク13に戻される。

【0011】上記実施例に係るクローズド型燃料電池システムは、燃料供給系として、水を保管する水タンク3、水タンク3中の水を吸収し下流へ送る水ポンプ2、固体電解質水電解装置1、同水電解装置1に電気を供給する太陽電池4、同水電解装置にて発生した水素、酸素より水を分離する第1の気液分離器6a、6b、水素タンク、酸素タンク13、コンプレッサ9a、9b、配管及びこれらの水、水素ガス、酸素ガスの流れを制御する複数の弁7a～7iを備え、また生成物排出系として、第2の気液分離装置8a、8b、同気液分離装置にて分離した水を前記水タンク3に送る配管、同部気液分離装置

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にて分離した水素、酸素ガスを夫々のタンク10、13へ戻す配管及び複数の弁を備えたことを特徴とする。従って、次のような効果を有する。

【0012】(1) 余剰電力を有効に利用できる充放電可能なクローズ型燃料システムを組むことができる。

(2) 燃料、及び排出物の全くないクリーンな燃料電池システムである。

【0013】(3) 純粋の酸素を用いるため、燃料電池の効率が空気を用いる場合よりも高い。(4) コンパクトで取り扱いが容易となるので移動体に搭載可能である。なお、上記実施例では、この発明を宇宙空間を航空する人工衛星等の宇宙機器に搭載する場合について述べたが、これに限定されず、その他の移動体用の電源装置や離島の灯台等人がいきにくい地点に設置する電源装置に適用することが可能である。

【0014】

【発明の効果】以上詳述したようにこの発明によれば、燃料電池の燃料及び酸化剤に水の電気分解にて発生する水素ガス、酸素ガスをを用いることにより、システムを完全にクローズシステムとし、これにより燃料消費及び排出物をなくし、クリーンでコンパクトなクローズド型燃料電池システムを提供できる。

【図面の簡単な説明】

【図1】この発明の一実施例に係るクローズド型燃料電池システムの説明図。

【符号の説明】

1…固体電解質水電解装置、2…水ポンプ、3…水タンク、4…太陽電池、5a、5b、8a、8b…気液分離器、6a、6b…ガス精製装置、7a～7i…弁、9a、9b…コンプレッサ、10…水素タンク、11…加湿器、12…固体電解質燃料電池、13…酸素タンク、14…電気出力。

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CLAIMS

[Claim(s)]

[Claim 1] The closed mold fuel cell system characterized by providing the following. Solid electrolyte water electrolysis equipment. The water tank with which the water supplied to this water electrolysis equipment was held. The power unit which supplies the electrical and electric equipment to the aforementioned water electrolysis equipment. The 1st vapor-liquid eliminator which removes moisture from the hydrogen generated with the aforementioned water electrolysis equipment, and oxygen, and is returned to the aforementioned water tank, The hydrogen tank which stores the hydrogen generated with the aforementioned water electrolysis equipment, and the oxygen tank which stores the oxygen generated with the aforementioned water electrolysis equipment, The solid electrolyte fuel cell which makes the hydrogen from the aforementioned hydrogen tank, and the oxygen from the aforementioned oxygen tank react, and generates the electrical and electric equipment, The compressor which returns the gas which removed moisture from exhaust air of the hydrogen of this solid electrolyte fuel cell, and an oxygen system, respectively, and was removed in moisture with the 2nd vapor-liquid eliminator returned to the aforementioned water tank, and this 2nd vapor-liquid eliminator to the aforementioned hydrogen tank and an oxygen tank.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to a closed mold fuel cell system applicable to the power unit installed in the point to which men, such as a power unit for mobiles and a lighthouse of a detached island, cannot go easily.

[0002]

[Description of the Prior Art] In order that an old fuel cell might use natural gas, coal gasification gas, etc. as fuel like common knowledge, the moisture which returned a part for the surplus to the fuel-supply system, or the gas turbine etc. was supplied as a working fluid and generated was collected by the water treating unit. For this reason, a fuel cell serves as 1 configuration equipment of a combined cycle power generation system, the whole system becomes large-scale and configuration equipment has also become complicated. Moreover, it is the fuel consumption type system which performs only power generation.

[0003]

[Problem(s) to be Solved by the Invention] This invention uses a system as a closing system completely by having been made in consideration of such a situation and using the hydrogen gas and oxygen gas which occur in the electrolysis of water in the fuel and the oxidizer of a fuel cell, loses fuel consumption and excretions by this, and aims at offering a clean and compact closed mold fuel cell system.

[0004]

[Means for Solving the Problem] The water tank with which, as for this invention, the water with which solid electrolyte water electrolysis equipment and this water electrolysis equipment are supplied was held, The 1st vapor-liquid eliminator which removes moisture from the power unit which supplies the electrical and electric equipment to the aforementioned water electrolysis equipment, the hydrogen generated with the aforementioned water electrolysis equipment, and oxygen, and is returned to the aforementioned water tank, The hydrogen tank which stores the hydrogen generated with the aforementioned water electrolysis equipment, and the oxygen tank which stores the oxygen generated with the aforementioned water electrolysis equipment, The solid electrolyte fuel cell which makes the hydrogen from the aforementioned hydrogen tank, and the oxygen from the aforementioned oxygen tank react, and generates the electrical and electric equipment, The 2nd vapor-liquid eliminator which removes moisture from exhaust air of the hydrogen of this solid electrolyte fuel cell, and an oxygen system, respectively, and is returned to the aforementioned water tank, It is the closed mold fuel cell system characterized by providing the compressor which returns the gas removed in moisture with this 2nd vapor-liquid eliminator to the aforementioned hydrogen tank and an oxygen tank.

[0005] Namely, the closed mold fuel cell system concerning this invention The water pump which absorbs the water in the water tank which keeps water, and a water tank as a fuel-supply system, and is sent to a lower stream of a river, The hydrogen generated with the power unit which supplies the electrical and electric equipment to solid electrolyte water electrolysis equipment and this water electrolysis equipment, and this water electrolysis equipment, It has two or more valves which control the flow of the 1st vapor-liquid eliminator which separates water from oxygen, a hydrogen tank, an oxygen tank, a compressor, piping and these water, hydrogen gas, and oxygen gas. as a product excretory system It is characterized by having piping and two or more valves which return piping which sends the water separated in the 2nd vapor-liquid decollator and this vapor-liquid decollator to the aforementioned water tank, the hydrogen separated in the said division vapor-liquid decollator, and oxygen gas to each tank.

[0006] In this invention, when there is dump power (at for example, the time of a solar-battery operation), from a water tank, water is led to solid electrolyte water electrolysis equipment, and this is electrolyzed into oxygen and hydrogen. The hydrogen and oxygen which were generated are separately kept on a tank. Excessive water is collected to a water tank. Moreover, the gas stored from the hydrogen tank and the oxygen tank at the time of the power need is led to the fuel electrode of a solid electrolyte fuel cell, and an air pole, and is generated. The generated water is collected to a water tank. Unreacted hydrogen and unreacted oxygen gas are returned to each tank.

[0007]

[Embodiments of the Invention] Hereafter, one example of this invention is explained with reference to drawing 1. In addition, drawing 1 shows the system in the case of carrying this invention in spacecraft machines, such as artificial health which carries out aeronautical navigation of the space. **** 1 in drawing is solid electrolyte water electrolysis equipment. The water tank 3 is connected to this water electrolysis equipment 1 through piping which infixed the water pump 2. Moreover, the solar battery 4 as a power unit is connected to the aforementioned water electrolysis equipment 1. The 1st vapor-liquid eliminator 5a and 5b is

connected to the aforementioned water electrolysis equipment 1. Here, gas-purifier 6a is connected to one vapor-liquid eliminator 5a, and 2nd vapor-liquid eliminator 8a is further connected to this gas-purifier 6a through Valves 7a and 7b. Gas-purifier 6b is connected to vapor-liquid eliminator 5b of another side, and 2nd vapor-liquid eliminator 8b is further connected to this gas-purifier 6b through Valves 7c and 7d. Both the aforementioned 2nd vapor-liquid eliminators 8a and 8b are connected to the aforementioned water tank 3.

[0008] Compressor 9a, the hydrogen tank 10, valve 7e, the humidifier 11, and the solid electrolyte fuel cell 12 are formed in the path which connects aforementioned valve 7a and vapor-liquid eliminator 8a of piping between 7b, and the above 2nd one by one. Moreover, compressor 9b, the oxygen tank 13, 7f of valves, the aforementioned humidifier 11, and the solid electrolyte fuel cell 12 are formed in the path which connects aforementioned valve 7c and vapor-liquid eliminator 8b of piping for 7d, and the above 2nd one by one. In addition, **** 7g, 7h, and 7i in drawing shows a valve, and **** 14 shows the electric generating power of the aforementioned solid electrolyte fuel cell 12.

[0009] The operation of the closed mold fuel cell system of such composition is as follows. First, the water stored in the water tank 3 is pressurized by the water pump 2, and is sent to the aforementioned water electrolysis equipment 1. Here, a solar battery 4 receives supply of power and it is electrolyzed into hydrogen and oxygen gas. After the hydrogen gas and oxygen gas which occurred remove moisture with the 1st vapor-liquid eliminator 5a and 5b, respectively, they raise purity by gas purifiers 6a and 6b, pressurize it by Compressors 9a and 9b, and are stored in the hydrogen tank 10 and the oxygen tank 13. The water separated with the 1st vapor-liquid eliminators 5a and 5b is returned to a water tank 3 through Valves 7h and 7i.

[0010] After being stored in the oxygen tank 13 and humidified to maximum vapor tension with a humidifier 11 through Valves 7e and 7f at the time of the need, the hydrogen of the fuel of a solid electrolyte fuel cell 12 is led to a solid electrolyte fuel cell 12, and generates the oxygen of the hydrogen tank 10 and an oxidizer here. The source of a humidifier 11 branches from the water pump outlet of the water supply system of solid electrolyte water electrolysis equipment 1. It dissociates in 2nd vapor-liquid eliminator 8b generated in an air pole side, and the water of the product of a fuel cell is collected by the water tank 3. After excessive hydrogen and oxygen remove moisture with the vapor-liquid eliminators 8a and 8b, they are returned to the hydrogen tank 10 and the oxygen tank 13, respectively.

[0011] The closed mold fuel cell system concerning the above-mentioned example The solar battery 4 which supplies the electrical and electric equipment to the water pump 2 which absorbs the water in the water tank 3 which keeps water, and a water tank 3 as a fuel-supply system, and is sent to a lower stream of a river, solid electrolyte water electrolysis equipment 1, and this water electrolysis equipment 1, the hydrogen generated with this water electrolysis equipment, The 1st vapor-liquid eliminator 6a and 6b which separates water from oxygen, a hydrogen tank, the oxygen tank 13, Compressors 9a and 9b, It has two or more valves 7a-7i which control the flow of piping and these water, hydrogen gas, and oxygen gas. as a product excretory system It is characterized by having piping and two or more valves which return piping which sends the water separated in the 2nd vapor-liquid decollator 8a and 8b and this vapor-liquid decollator to the aforementioned water tank 3, the hydrogen separated in the said division vapor-liquid decollator, and oxygen gas to each tank 10 and 13. Therefore, it has the following effects.

[0012] (1) The closed type fuel system which can use dump power effectively and in which charge and discharge are possible can be constructed.

(2) They are fuel and the clean fuel cell system of excretions which is not.

[0013] (3) In order to use pure oxygen, it is higher than the case where the efficiency of a fuel cell uses air. (4) Since handling becomes easy with a compact, it can carry in a mobile. In addition, although the above-mentioned example described the case where this invention was carried in spacecraft machines, such as artificial sanitation which carries out aeronautical navigation of the space, it is possible to apply to the power unit installed in the point to which it is not limited to this and men, such as a power unit for other mobiles and a lighthouse of a detached island, cannot go easily.

[0014]

[Effect of the Invention] By using for the fuel and the oxidizer of a fuel cell the hydrogen gas and oxygen gas which occur in the electrolysis of water according to this invention, as explained in full detail above, a system is completely used as a closing system, this loses fuel consumption and excretions, and a clean and compact closed mold fuel cell system can be offered.

[Translation done.]

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L12: Entry 9 of 16

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ABSTRACT:

PROBLEM TO BE SOLVED: To provide a perfectly closed system to eliminate fuel consumption and emission matter, and make the system clean and compact by using the hydrogen gas and oxygen gas generated by electrolysis of water as fuel and oxidizing agent.

SOLUTION: The water stored in a water tank 3 is pressurized by a water pump 2 and sent to a solid electrolyte water electrolytic device 1. Power is supplied by a solar battery 5 to electrolyze the water into hydrogen and oxygen gases. The generated hydrogen gas and oxygen gas are increased in purity by gas purifying devices 6a, 6b after moisture is removed by first gas-liquid separators 5a, 5b, pressurized by compressors 9a, 9b, and stored in a hydrogen tank 10 and an oxygen tank 13, respectively. The hydrogen for the fuel of a solid electrolytic fuel cell 12 and the oxygen for oxidizing agent are stored in the tank 10 and the tank 13, respectively, and when required, they are guided to the cell 12 after humidified to a saturated steam pressure by a humidifier 11 through valves 7e, 7f to generate electricity. Thus, a closed system can be provided, and the system can be made clean and compact.

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